those of *Percopsis*. The genera may be distinguished as follows: —

A. Dorsal with two feeble, slender, unbranched rays; anal with a single similar ray; scales most strongly ctenoid on caudal peduncle; posterior margin of preopercle entire or with feeble crenulations; form slender. *Percopsis.*

AA. Dorsal and anal each with two very strong spines; scales most strongly ctenoid on anterior part of body; posterior margin of preopercle with a few short but strong spines; form heavy, deep. *Columbia.*

Diagnosis of *Columbia transmontana* E. and E., sp., nov.: —

Head, $3\frac{1}{3}$–$3\frac{1}{2}$ (3 in the young); depth, $3\frac{1}{2}$–$3\frac{3}{8}$ (4 in the young); dorsal, II., $9\frac{1}{2}$; anal, II., $6\frac{1}{2}$; scales, 769–44 to 46–7.

Body comparatively deep, the dorsal profile more arched than the ventral, making an angle at the origin of the dorsal fin; sides compressed, caudal peduncle most so. Head short and chubby; eye equal to snout, about $3\frac{1}{4}$ in the head. First dorsal spine about equal to the pupil, second spine one-half length of head, recurved and very deeply grooved behind. Anal spines somewhat lower than the dorsal spines; ventrals reaching past vent. Nape, with the exception of occipital spine, scaled. Translucent in life. Color generally smutty. Side with three rows of more or less oblong blackish spots, the middle and superior rows most noticeable. Back with a series of similar spots, one being conspicuous at beginning and end of first dorsal. Dorsal mottled, caudal barred. Head smutty, a blue-black spot on middle of opercle, a narrow, silvery, lateral band. Young translucent, with well-defined dark spots.

The greater part of the specimens belong to the British Museum.

MICHIGAN MINING SCHOOL.[1]

THE committee appointed by you to act as a Board of Visitors to the Michigan Mining School respectfully report as follows: Finding it impossible to arrange a date which would enable the entire committee to make the inspection at the same time, two of us visited the institution on Wednesday and Thursday, March 30 and 31, and the third on April 8 and 9. We were cordially received, and every effort was made to place us in possession of the items asked for and appertaining to the duties assigned us. The examination was as careful and searching as time would permit.

The first visit was made during the progress of the regular work, aud the second during examination week at the close of the term. Thus the opportunity was afforded the committee of witnessing the work of students in the class-room and laboratories, as well as the results of that work as exhibited by the examinations. So far as we are able to judge, the work of the institution is being pushed along its legitimate lines and solidly and conscientiously performed both by students and instructors. The lectures indicated carefulness of preparation and thorough understanding of the subjects taught on the part of the instructors, and the character of the examinations showed that there was no disposition to accept less from the students. We were favorably impressed with the earnestness of purpose which seemed to pervade the students as a body, and with the manifest fitness of the members of the faculty for their special lines of work. Some of these men, we understand, left much more lucrative positions on account of their love for their specialty, and their desire to devote themselves exclusively to it. Such men cannot fail to do strong work. It was with regret that we learned, soon after our visit, of the resignation of Dr. Keller. He is unquestionably one of the ablest men in the institution. The building, rooms, laboratories, apparatus, and machinery all indicate efficiency on the part of those having them in charge. The Mining School is purely and distinctly a professional school, having for its object the practical training of its students in mining engineering, and we believe it is carrying out the purpose for which it was established. Of course, much of the theoretical is taught, but so far as your committee could learn, it is with sole reference to its practical bearing upon what is to follow.

[1] Report to Hon. Ferris S. Fitch, Superintendent Public Instruction, Michigan, by a committee consisting of D. A. Hammond, Perry F. Powers, and S. E. Whitney.

Although much time is spent upon theoretical mathematics, the object is to give the student a mastery of those principles which will be necessary in his after work of surveying and engineering. The students are then taken to the field and into the mines, and, under the guidance and direction of an expert (Professor Denton), are taught the practical applications of the principles learned, and other necessary operations of mining. The same methods prevail in the other departments of the school. It is this element of practicability in all the work of the school, in our opinion, which has brought to the school the very general support of the people of the Upper Peninsula and of mining men in particular. The consensus of opinion among all classes is that the school has a direct and financial value to the State. It promotes intelligence in methods of mining, develops inventiveness in the line of mining machinery, and directs thought to measures for securing greater safety to miners.

Your committee, or at least one member of it, before visiting the school had always regarded it as an expensive one considering the number of students enrolled. But after careful investigation at the school and an examination into the methods pursued by the Board of Control, there can be do doubt but that all means appropriated have been economically and intelligently expended. Of course it is well understood by all that technical education is necessarily much more expensive than general education, on account of the peculiar character of the work. The equipment, including buildings, laboratories, apparatus, machinery, and collections in geology, is very costly. A comparison of the per capita cost at the Michigan Mining School, however, with the cost at other similar institutions shows that the Michigan school is among the cheapest. This cost will decrease as the number of students increases. The faculty as at present constituted could undoubtedly handle a larger number of students than are now enrolled in the school (76), and yet the work of the various departments could not be satisfactorily performed with a less number of instructors. In fact, were it not for the union of the school and the geological survey, the faculty would have to be increased; but this arrangement adds to the teaching force for a large part of the year three skilled assistants, Drs. Lane and Patton and Professor Seaman.

This brings us to the consideration of the question of the union of the mining school and geological survey. We believe this arrangement to be mutually advantageous and a direct saving to the State. It places at the head of the Survey, as State Geologist, the Director of the school, Dr. Wadsworth, who is eminently qualified both as to scholarship and executive ability for the positions he holds, and strengthens the faculty of the school by adding to the teaching force the three capable members of the survey. With the means at the command of the Geological Board it would be impossible to retain the services of these men; but by dividing their time between the survey and the school, and receiving a part of their salary from the survey and part from the school the State is enabled to retain them in its employ. It also furnishes convenient headquarters for the survey and places at the service of the school its valuable geological collections. At no other place in the State could this collection be so well preserved and made of such practical value. The wisdom of locating the school where it is, is apparent to all who have ever visited this region. It is surrounded by some of the richest copper and iron mines in the world, and the student has the opportunity of making constant practical application of his studies. Some means, however, should be adopted at once to reduce the expense of living to the students. We understand that it is very difficult for the students to find rooms and board without paying exorbitant prices therefor. If means could be devised for relieving this condition of things it would be well, in fact, it is almost imperative that something be done in this direction. There ought to be a room at the building, also, large enough for an assembly-room. There are many occasions when it is quite important to bring the students together in a body. We believe, also, that the heating apparatus should be removed from the main building and placed in a building by itself.

The Michigan Mining School, we may say in closing, has come to stay; because it has demonstrated its fitness to live. Whatever

may have been its weakness in the past it is now doing valuable work. It is well equipped, has an able Faculty, and a demand upon it greater than it can now supply. We see no reason why it should not be a very valuable auxiliary in the future development of the mining resources of the State.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

On the Interpretation of the Markings on Mars.

IN view of the large mass of conflicting observations of Mars now being reported, it occurs to me to mention one principle of interpretation which has not to my knowledge been suggested. On Mars, as on the moon, may it not be true that the most conspicuous permanent markings are due, not to land and water surfaces, but to contrast of mountain and plain? Mars through even a large telescope is brought scarcely closer than the moon appears to the naked eye, and it presents a general marking analogous to the "man in the moon," which we know to be but a shadow feature. (See, for example, Plate xxxiii. in *Astronomy and Astro-Physics*, October, 1892). If the permanent water surface of Mars is only one-half the area of the Mediterranean Sea, as lately estimated by Professor Pickering, it is, of course, impossible that the light and dark patches represent land and water; but the supposition that they represent, in general, open plain and rugged hill-country throws light on certain perplexing phenomena. The so-called canals are then probably mountain ranges separated by plateaus, and the so-called duplication is a bringing out by higher powers of outlying spurs and ranges, which with lower powers are either indistinguishable or mingled with the general mass. As our seeing improves, we may expect triplication, quadruplication, etc. An observer on Mars looking through a telescope at the Rocky Mountains from a distance of 100,000 miles would discern merely a long dark blur, while upon closer scrutiny he might distinguish parallel and off-shoot ranges with their foot-hills as separate dark lines, which might be termed "canals." The apparent straightness and regularity of the "canals" is doubtless the effect of distance.

By this interpretation we solve the difficulty suggested by Professor Pickering in *Astronomy and Astro-Physics*, October, 1892, p. 669, that some "very well developed canals cross the oceans." These "canals," then, are hilly peninsular extensions or ranges of mountainous islands. From Mars, Italy or Java would appear but as dark streaks in a greenish or bluish medium. Mr. Barnard mentions in the same number (page 683) that "long luminous streaks" seem to be a definite feature of the planet's surface. These are probably lines of snow-capped peaks. We must, on the whole, believe that the seas, lakes, and canals of Schiaparelli's map are as mythical as the seas of the moon.

When one compares the extremely diverse drawings of Mars given in the October *Astronomy and Astro-Physics*, one cannot but suspect that clouds have a large part in producing this diversity. The general appearance of the earth from Mars would certainly change from hour to hour from this cause alone. Predominant and cloud fog probably caused the "absolutely colorless, dark-gray" appearance of the Martian oceans, noted by Professor Pickering for a considerable time (*Astronomy and Astro-Physics*, p, 546 cf., p. 669). Similarly the North Atlantic, which might often appear from Mars as a blue or green spot, might for some time, in the spring of the year especially, be a dark-gray patch.

We must consider it likely that some of the rapidly darkening spots which Mr. Pickering observed were due rather to springing vegetation caused by showers on barren tracts than to inundation, particularly the case he mentions where a dark area suddenly appeared to the "south east of the northern sea and of fully double its area." It seems hardly possible, if the snows on Mars are as light as Professor Pickering represents, that such extensive inundations could occur; and it is simpler and more in accord with general analogy that many such temporary dark or gray-green spots should be due to vegetation rather than to water.

Professor Pickering did so admirably with his 13-inch instrument, that we may well believe that, if he had had a 30 or 40-inch telescope, he would now be able to give us a tolerably accurate account of the general physiography of Mars. We hope his appeal for a thorough equipment will meet a ready response.

HIRAM M. STANLEY.

Lake Forest University, Oct. 11.

The Lines on Mars.

IN *Science*, Sept. 23, Mr. C. B. Warring communicates a theory to account for the gemination of the so-called canals of Mars. He suggests that the phenomenon may be due to a defect in the eye of the observer by reason of its possessing the power of double refraction in some or in all directions. That some eyes do possess the power of double refraction is a well-known fact. It is a defect which, I imagine, is much more common than is generally supposed. It may be suggested that data representing a large number of cases *might* show astigmatic eyes to possess the power of double refraction more frequently than others. I do not know that any data have been collected upon this point.

Concerning the existence of the canals of Mars and that they are sometimes really double, I have no doubt. My own recent work at the Lick Observatory has convinced me that they are not illusions due to imperfect eyesight. During the present opposition, I spent about thirty nights in the work on Mars, working with Professors Schaeberle and Campbell. On about half the nights I saw the so-called canals with more or less distinctness, but on only one occasion did I clearly see a canal double. This was August 17, when the canal called Ganges on Schiaparelli's map was clearly seen to be double, and was so drawn in my note-book. That the doubling was real and not apparent is evident from the fact that Professors Schaeberle and Campbell both saw the same canal double on the same night, and drew it so. Other canals, some of them nearly parallel to Ganges, were seen that night, but none of them appeared double.

Our work was done independently. In turn each went to the telescope, and made a drawing of what he saw. We did not see each others' drawings, nor did we talk of what we had seen. It was not until the next morning that we learned that each had seen Ganges double.

WILLIAM J. HUSSEY.

Leland Stanford, Jr., University, Palo Alto, Cal.

A New Habitat of the Black-Throated Rock Swift, Micropus Melanoleucus.

AS curator of the museum, I have just procured for the State University of Nebraska a set of bird-skins prepared during the past summer, among which are five skins that must be of interest to ornithologists. They verify the discovery made by Professor Lawrence Bruner of the University of Nebraska, that the White-throated Rock Swift builds and breeds in the precipitous bluffs around Squaw Canon, Sioux Co., Nebraska, and, what is more likely, throughout the Pine Ridge regions, as Professor Bruner has observed them also at Crow Butte, near Crawford, Nebraska.

This isolated habitat of the White-throated Rock Swift, Micropus Melanoleucus (Panyptila Saxatilis), is several hundred miles east of its most eastern limits as known hitherto. Perhaps the Pine Ridge Buttes and bluffs, particularly those about Squaw Canon, are so admirably adapted to their nesting and high-flying habits as to be the attractive forces.

Although five specimens were secured, no eggs were found. It should be mentioned, perhaps, that the egg of this swift is unknown. However, it is the expectation of the author that they will be found on some of his own, or some of the other numerous excursions sent annually to this excellent field by the university.

The nests are built high up in the cliffs, in the most inaccessible places. The semi-lithified sandstone of these buttes is easily excavated; and, as nearly as could be learned, the swifts dig back about eighteen inches, the opening barely admitting the hand but expanding somewhat at the nest. The nests are built of grass.